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Flame Spread along Fuel Cylinders in High Pressures

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Abstract : Flame spread over solid fuels in high pressure situations such as nuclear containment shells and hyperbaric oxygen chamber has potential to result in catastrophic disaster, thus requiring best knowledge. This paper reveals experimentally the flame spread behaviors over fuel cylinders in high pressures. The fuel used in this study is polyethylene and polymethyl methacrylate cylinders with 4mm diameter. Ambient gas is fixed as air and total pressures are varied from naturally normal pressure (100kPa) to elevated pressure (400kPa). Flame appearance, burning rate and flame spread were investigated experimentally and theoretically. Results show that high pressure significantly affects the flame appearance, which is as the pressure increases, flame color changes from luminous yellow to orange and the orange part extends down towards the base of flame. Besides, the average flame width and height, and the burning rate are proved to increase with increasing pressure. What is more, flame spread rates become higher as pressure increases due to the enhancement of heat transfer from flame to solid surface in elevated pressure by performing a simplified heat balance analysis.

Keywords : cylinder fuel, flame spread, heat transfer, high pressure
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